

The embodiment of FIG. 10 can be applied also to a single-channel electrophoretic chip and a multi-channel electrophoretic chip. For example, when the chip 2 shown in FIG. 8C is used, by arranging eight LEDs side by side corresponding to positions of the intersections between the specimen-introduction passage 4 and the separation passage 6, it is possible to apply an excited light to each of the intersections, thus monitoring a specimen distribution at the intersections.

Although in the embodiment of FIG. 10 the LED 119 is disposed corresponding to the position of the intersection between the specimen-introduction passage 11 and the separation passage 13 of the chip 1 to apply an excited light from the LED 119 directly to the intersection 10, a convergence lens may be disposed between the LED 119 and the chip 1, for example, to apply the excited light from the LED 119 therethrough to the intersection or, in the configuration shown in FIG. 5, the movable reflection mirror 75 may be omitted and, instead, an LED may be disposed on the side of the lens 77 opposite to the dichroic mirror 79 to thereby apply an excited light from the LED through the lens 77 and the dichroic mirror 79, thus applying the excited light from the LED through the optical system to the chip 1.

Such an embodiment of FIG. 10 that is provided with the detecting optical system using an LED as its light source can reduce the cost of the light source itself and hence the costs of the specimen-injection monitor mechanism. Furthermore, by arranging an LED array corresponding to a layout at a site where the specimen is injected, there is no need for a complicated optical system for illumination, thus enabling further reducing the costs of the specimen-injection monitor mechanism.

The electrophoretic chip that can be used in an electrophoretic apparatus according to the embodiment of FIGS. 5 and 10 is not limited to such that has one passage formed as intersecting with the separation passage. For example, it may be such an electrophoretic chip that has formed therein a separation passage with no intersection with any other passages, that has a plurality of passages intersecting with each other as the separation passage, that has a large size, or that has any other various designs of the passage.

Corresponding to the design of the passages of the electrophoretic chip, however, it is necessary to modify the voltage supplying mechanism, the detecting mechanism, and the specimen-injection monitor mechanism.

Although in the embodiment shown in FIGS. 5 and 10 the specimen-injection monitor mechanism and the detecting mechanism use a fluorescent-light detecting optical system, the invention is not limited to it, and in place of the specimen-injection monitor mechanism and the detecting mechanism, any other mechanism using an absorptio-metric or electric-conductivity method or the like may be utilized.

By providing an electrophoretic chip used with mutually intersecting specimen-injection passage and separation passage as its passages and using a voltage supplying mechanism to apply a voltage for guiding a specimen to an intersection between the specimen-injection and separation passages so that if, subsequently, the specimen distribution is not uniformed yet even after a predetermined time has elapsed within a predetermined range along the specimen-injection passage detected by the specimen-injection monitor mechanism, a control part, further provided, may once stop the apparatus, and it can be decided automatically whether the electrophoretic migration of the specimen is acceptable, thus controlling that migration.

Although in the embodiments shown in FIGS. 5 and 10 the CPU 87 and the CPU 103 are provided for the monitor optical systems 89 and 89a and the detecting optical system 105 respectively, one CPU may be used to perform the functions of both the CPU 87 and CPU 103.

By the embodiments shown in FIGS. 5 and 10, it is also possible to discuss the conditions for injecting the specimen. By changing the temperature of the chip 1, the voltages fed to the reservoirs by the high-voltage supplying part 109, and the time lapse for the voltage application on these reservoirs, a specimen distribution in the specimen-introduction passage 11 can be monitored using the monitor optical system 89 or 89a under various conditions. This enables discussing optimal injection conditions.

Conventionally, manual operations have been used to fill the micro-chip with an electrophoretic medium, to remove the electrophoretic medium from the

reservoir, to inject a specimen and a buffer liquid into the reservoirs, to remove the specimen from the reservoirs after injected in the separation passage, and to inject the buffer liquid into the reservoirs after the specimen removal. These operations, however, are very troublesome for the operator who must do them by hand using a syringe and the like.

An embodiment of the electrophoretic apparatus to solve this problem by automating those operations shall be shown in FIG. 11. FIG. 11 is a perspective view for showing a schematic configuration of the embodiment. The electrophoretic chip 1 is the same as that shown in FIG. 2, in which it is indicated, however, as having one separation passage and one specimen-introduction passage which intersect with each other in order to make the description simple.

A chip-holding mechanism (not shown) is provided to hold the electrophoretic chip 1, so that the chip 1 held thereon is moved by a moving mechanism provided to the chip-holding mechanism in an arrow direction 111 between positions A, B, and C in the figure.

Above the position A is provided a port 113 for sucking an electrophoretic medium and injecting a buffer liquid. The port 113 includes a nozzle-fixing member 115 and four pairs of a suction nozzle 117 and a discharge nozzle 119 which are fixed to the member 115 corresponding to an arrangement of the reservoirs 15a, 15c, 15s, and 15w when the chip 1 is positioned at the position A. The suction nozzle 117 and the discharge nozzle 119 are connected to independent syringes (not shown) respectively. Furthermore, the port 113 is provided with an elevation mechanism (not shown) for lifting/lowering the member 115 in an arrow direction 121 in the figure. The elevation mechanism lowers the member 115 so that the tips of the nozzles 117 and 119 may advance into the reservoirs 15a, 15c, 15s, and 15w when the chip 1 is at the position A.

The electrophoretic medium-suction-and- buffer liquid-injection port 113, the syringes, and the elevation mechanism constitute an electrophoretic medium-suction mechanism and a buffer liquid-injection mechanism.

As the nozzles 117 and 119 a resin-made capillary, for example, may be used. The nozzles 117 and 119, however, are not limited to a resin-made capillary;